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Japanese Banks' Behavior Under Long-run Customer Relationships in the Second-half of the 1990s

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Contents

1. Introduction

In the 1980s, US banks' lending growth rate had been in a slump. This was called "Credit crunch" and had become issue in the early 1990s. Since then, there have been many preceding studies about the Credit crunch which occurred in US banks, such as Bernankle-Lown (1991), Berger-Udell (1994) and so on. It has been supported empirically that the Credit crunch in the US, especially in New England, was a "Capital crunch", because the capital of US banks had been reduced through falling real-estate prices, and US banks had repressed lending in order to meet BIS capital adequacy requirements.

On the other hand, in Japan, the "bubble economy" had burst in the early 1990s, and stock prices such as real-estate prices, share prices and so forth, drastically fell. As the result of that, Japanese banks' lending growth rate had been in a slump, and bankruptcy of medium and small companies or economic slump had become a big issue. However, in the first-half of the 1990s, there were only a few interpretations that the capital crunch caused a decrease of the lending growth rate. For example, Yoshikawa-Etou-Ike (1994) pointed out that bad assets of Japanese banks affected lending negatively, also pointed out that the demand side's factor was relatively more dominant than the supply side's, with a considering decline of interest rates. In this regard, Yoshikawa-Etou-Ike (1994) did not deny the existence of supply side's factor itself.

Until the second-half of the 1990s, there were not any studies which affirmed the existence of the supply side's factor or emphasized it as the factor of decreased lending, such as Maeda (1996), Ito-Sasaki (1998), Sasaki (2000), and so on. They pointed out that the bad

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assets affected lending negatively, by regression analysis between lending and bad assets, etc.

Among the empirical studies referred to above, the reason there were differences as to conclusion is likely due to differences of the analyzed period as well as methods and data used in analysis.

At first, the bad-asset problem of Japanese banks was not a big matter socially, because the first-half of the 1990s was just the opening period when the bubble economy burst. However, afterward, with continuing economic sluggishness, the failure of the jusen housing loan companies caused the bad assets of banks to be noted socially, and also the bankruptcy of Japanese financial institutions went in a row, in 1997 and 1998. As a result, in the second-half of the 1990s, the terms expressing "banks' reluctance to loan" ("kashi shiburi" or "kashi hagashi" in Japanese) had come to be frequently used by mass media. As to the background of that, it had likely dominantly emerged that the slump in demand for loans had not been able to explain by itself the decreasing loans made by banks.

To support whether or not the supply side was dominant theoretically, it needs to be explained why loan interest rates did not rise despite banks' reluctance to loan in Japan. As to this point, Maeda (1996) and Fueda (1999) explained that because of the increase of bad assets, banks' lending posture became more deliberate, banks developed a sensitivity to the adverse-selection of borrowers in the loan market, and adjusted excess demand for loans not by raising the interest rate but by rationing credit, using the model presented by Stiglitz-Weiss (1981). However, suddenly rejected loans with banks' circumstances, the borrowers noted socially as the "victims" of "banks' reluctance to loan" were particularly medium and small companies, regardless of having long-run customer-relationships with banks until then. In Stiglitz-Weiss (1981), the long-run customer relationship between banks and borrowers was not considered[1].

Hence, this paper proposes an assumption that the disruption of the long-run customer relationships can be looked on as "banks' reluctance to loan" by the borrowers' side, and considers this assumption.

The rest of paper is organized as follows. Section 2 describes the notion of the long-run customer relationship and the implicit contract as minimum as possible, to assist the following consideration. Section 3 considers the formation and disruption of the long-run customer relationship. Section 4 considers how banks cope with the alternative between rationing credit and raising the interest rate in deviating from the long-run customer relationship, consulting with the notion of auction game models. Section 5 points out remaining issues in lieu of a conclusion.

2. Long-run customer relationship and implicit contract

Differing from finance through security markets, transactions in loan markets are usually exclusive, face-to-face and long-term. And there have been many preceding studies

that tried to characterize the transaction form through the notion of the long-run customer relationship and the implicit contract[2]. Fama (1985), one of them, pointed out that "inside information" has accumulated in the bank through repeating transactions over and over again, not considering the relationship as a given. Based on this viewpoint, Sharpe (1990) and Baglioni (1992) attempted to explain dynamically, and noted the accrual of information gaps about borrowers, between the "inside bank" and the "outside bank". We regard the bank lending to a borrower continually and actually as the "inside bank", and the other banks as the "outside bank".[3] That is to say, as a result of the inside bank accumulating information about the borrower through the experience of past transactions, the bank comes to have monopoly of power by gaining superiority to the outside bank, and the customer relationship continues because they (the inside bank and the borrower) thought to profit from the inside bank's monopoly power. In addition, Sharpe (1990) gave proof that, by using a dynamical framework, under the implicit contract, the loan interest rate, which is lower and more stable than the interest rate proposed by the outside bank, stabilizes through the relationship continuing over the multiperiod. Moreover, Sharpe (1990) elicited the point that the discount factor for the bank's future profits is sufficiently large (i.e. the discount rate is sufficiently small), as a requirement to form the long-run relationship, too.

In this regard, the continuing of the long-run relationship or the implicit contract is characterized not as being stipulated by a law or a legal contract, but as being profitable between interested parties agreeing to it implicitly. If possible, making an explicit contract and restricting each other legally may prevent a breach of promise, although it is impossible to predict future profits of a borrower or finance costs of a bank precisely beforehand. Even if it is possible to make a conditional contract enumerating all of the situations that can happen in the future ahead of time, the cost of making such a contract is impossibly high. Hence, to prevent a breach of promise while not binding each other by the explicit contract, there should be a mechanism by which the interested parties can make profit standing only by the implicit contract. When either of them breaches the agreement, both of them incur some penalties. In that case, it can be expected that the mechanism is much better for the interested parties than making an expensive explicit contract, and is able to prevent a breach of agreement to some extent.

Why, then, is the mechanism profitable for the both of the interested parties? At this point, we will survey the notion of the preceding studies succinctly for the following consideration.

Because the change of external environments accompanies the varying of terms of financing, to level that varying, it is first necessary that the incentive to form an implicit agreement in both lender and borrower arise. In other words, if both agree that the inside bank does not tighten up the terms when a borrower's performance is bad, and, on the other hand, the borrower does not borrow from another bank proposing more favorable terms but from the inside bank even when the borrower's performance is good, the agreement turns out that the inside bank gives financial subsidy in tightening finances, and, on the other

hand, the borrower gives part of profit to the inside bank while financially sound. The incentive, which has the borrower commit such an agreement, arises from the fact that the borrower can reduce the financial impacts suffered from the changing of external circumstances, by leveling the varying of financing cost through the agreement[4]. In addition, as a result of accumulating information about the customer (the borrower) by repeating transactions with the same borrower, the inside bank can get a monopoly rent, because the cost incurred by changing customers weakens competition among banks.

In this regard, for both sides, to continue the customer relationship based on such an implicit agreement, it is necessary that cost accompanies changing the counterparts, for the bank side as well as the borrower side. In fact, in order for a bank (the outside bank) to start transactions with a borrower with which has not transacted until now, the bank needs to produce information about the borrower and the production cost of the information is reflected in the lending terms, because it costs to become the new inside bank for the outside bank. On the other hand, the inside bank can save the production cost of the new information about the borrower; the cost to form the relationship has been already sunk into the past, and the inside bank has gained an advantage over the outside bank, with regard to the amount and quality of the information[5].

Therefore, because disrupting the relationship once formed creates new costs for both parties, there is an incentive to continue the relationship for them, as long as the merit of continuing is larger than the demerit.

Next, we will define the risk (or quality) of borrowers (i.e. firms), in an extremely simplified form (to avoid being too complex for the following discussions).

We assume the following: Each firm has one project of investment. The gross rate of return from the investment project which each firm confronts is probability variable. The expectation value of the variable is the same among all firms. The variance value of the rate of return differs among each firm, and there are only two values as the variance value. And we regard the firm which has a project with a larger variance value as "high risk" (i.e. bad quality), and the firm which has a project with a smaller variance value as "low risk" (i.e. good quality). As a result based on above assumptions, there are only two types of firms, "good" or "bad". In addition, the ratio of the "good" or the "bad" in all firms is constant, and all banks know about the ratio through their experiences. The gross rate of return does not vary through the elapsing of time, and has identical and independent probability distribution (i.i.d.). Besides, although the firm itself knows the risk of its project, the firm can not exactly inform the outside bank[6] of it. On the other hand, the inside bank can know exactly the degree of the risk of the project the firm has (i.e. there is not asymmetric information between the firm and the inside bank).

The reason the inside bank can get the rent from the long-run relationship is because the outside bank cannot know the risk of the customer of the inside bank. The inside bank can propose a low interest rate to the firm which only the inside bank knows is "good". However, in fact, the inside bank can impose upon the firm a rate which is higher than the

break-even rate and is lower than the rate the outside bank proposes. In this case, if the inside bank imposes an interest rate (within the range from the break-even rate to the rate proposed by the outside bank) to the firm, the inside bank earns the difference between the rate actually imposed and the break-even rate.

On the other hand, to the firm which the bank knows is "bad", the inside bank proposes a higher rate based on the risk. However, the outside bank cannot directly observe the risk of the "bad" firm. Hence, if the outside bank thinks of the fact that firms are composed of "good" and "bad", and propose the break-even rate as the expected value, calculated based on the ratio of the "good" firms to the "bad" firms, the firm, which has borrowed at the higher rate from the inside bank until then, will want to borrow from the outside bank. This is because the rate, which is imposed based on accurate risk by the inside bank, is higher than the rate proposed by outside bank. In other words, because the outside bank's calculation involves the ratio of the "good", the rate proposed by the outside bank becomes lower than the rate imposed by the inside bank based on an accurate degree of the risk. Therefore, because the outside bank can easily predict that riskier firms will apply to borrow if it proposes the rate based on the ratio of the "good" to the "bad", it won't in fact propose such a rate but a rate based on the idea that the firm is certainly "bad". As a result, the "bad" firm is always proposed the same high rate from the outside bank as well as the inside bank. Therefore, when the firm is "bad", because the inside bank cannot earn extra rates by exploiting the difference in the rates, there is no merit in forming a long-run customer relationship for the inside bank. Namely, it is only when the firm is "good" that the inside bank can earn the rent and they (the inside bank and the customer firm) can share it with each other[7]. This is important for the following discussion.

Moreover, we highlight as an important point that the inside bank does not announce the rate which is applied to its customer to the outside bank. The reason is because, if the inside bank announces the rate, the outside bank knows it at free cost and may rob the inside bank of the customer, by such means as temporarily proposing a lower rate.

3. The formation and the disruption of the long-run customer relationship

In this section, we consider whether or not the incentive, which has the interested parties deviate from the customer relationship, occurs if the mechanism, seen in section 2 as having the interested parties form the long-run relationship, changes for some reason[8].

Based on the consideration of section 2, in this section also, we confine the considered object to the firm which is known as "good" by the inside bank. The break-even rate in loaning to the customer for the inside bank, is denoted by r^i, and, on the other hand, the break-even rate for the outside bank is denoted by r^o.

When there is difference as to the amount of information about the firm between the inside bank and the outside bank, and if the inside bank knows the firm is "good", the break-even rate for the inside bank, r^i, should be lower than for the outside bank, r^o. The

difference is denoted by c. Therefore,

(1) $r^o = r^i + c$, and $c > 0$.

If the inside bank proposes the rate which is equal to r^o to the firm, its monopoly rent is c, which is equal to the difference between actual break-even rate for the inside bank, r^i, and the proposed rate, r^o. In this case, because the firm may change its bank into the outside bank, the inside bank cannot help proposing the rate which is lower than r^o, actually. We denote the rate as $\bar{r}$. On the other hand, because the minimum rate the outside bank proposes is r^o, the inside bank distributes part of the monopoly rent, $r^o - \bar{r}$, to the firm, by proposing $\bar{r}$ to the firm. The inside bank assuring part of the rent to the firm, and the firm also approving not to change its bank, forms the implicit contract. Namely, it lets such an implicit contract be formed that the monopoly rent stems from informational difference between the inside bank and the outside bank.

The distribution of the rent mentioned above is only explained as the transaction in one period. Then, we develop this to the framework of the simultaneously and infinitely repeated game as the following: We suppose that, as the inside bank proposes the rate $\bar{r}$ (lower than r^o) and the firm does not borrow from the outside bank, they behave cooperatively with each other, or either of them can also choose to deviate from the cooperative behavior. Needless to say, the customer relationship continues as long as both of them behave cooperatively.

In the repeated game, in order that both of them continue such cooperative behavior, the cooperative strategy must constitute a subgame-perfect Nash equilibrium in the whole repeated game, and, for that, the strategy must also constitute a Nash equilibrium for the both sides in each subgame after each period[9].

The firm side does not have the incentive to deviate from the customer relationship . Therefore, as is given that the firm will continue the customer relationship, the inside bank will continue the customer relationship if the long term profit, which the inside bank earns in continuing the customer relationship in the infinitely repeated game, is larger than the short term profit, which the outside bank earns in deviating from the customer relationship[10].

Deviating from the customer relationship and imposing the same rate, r^o, as the outside bank on the firm, the inside bank earns the rent, $r^o - r^i > 0$, at the present period, and does not earn the rent from the next period. On the other hand, continuing the relationship, the inside bank earns the rent, $\bar{r} - r^i > 0$, in each period from the present period. We denote the discount factor as to the future profit for the inside bank as δ_B. Therefore, as the discounted present value of them,

(2) $$\frac{1}{1-\delta_B}(\bar{r} - r^i) \geq r^o - \bar{r}.$$

If the equation (2) holds, the inside bank does not deviate from the relationship[11]. From the equation (2), we can point out as follows;

(i) The smaller the discount factor, δ_B, of the inside bank, the smaller the value of the left-hand side of the equation (2).

(ii) The smaller $\bar{r}-r^i$ relative to $r^o-\bar{r}$, the smaller the left-side of the equation (2).

To see the relation between (i) and (ii), transforming the equation (2) as to $\bar{r}$, we get

$$(3)\quad \bar{r} \geq \frac{1-\delta_B}{2-\delta_B} r^o + \frac{1}{2-\delta_B} r^i.$$

Therefore, after the inside bank has set the value of $\bar{r}$, the rising of r^o or the falling of δ_B reverses the inequality sign of the equation (2), and then, the probability of the deviation from the customer relationship for the inside bank rises[12]. To avoid this, although the inside bank has only to raise $\bar{r}$, the bank cannot do so when the upper value is confined by the implicit contract, and deviates from the relationship. As to the factor of raising r^o, it can be pointed out that the uncertainty of the evaluating the quality of the firm increases. As to the factor of reducing δ_B, it can be pointed out that the probability of ending the game increase with the deterioration of the external circumstances, or the inside bank comes to prefer nearer future profit than before[13, 14]. In this regard, as Sharpe (1990) pointed out, if it is widely known in the loan markets that the bank is violating the implicit contract by deviating from the relationship, the bank, which flawed its own reputation, comes to have difficulty acquiring new customers. For this reason, actually, it is difficult that the inside bank raises the applied interest rate $\bar{r}$ posteriori. Therefore, as the factor of deviation from the customer relationship, the decrease of δ_B, the inside bank's circumstances, as well as the increase of r^o, the outside bank's circumstances, is possible. (The increase of r^o also means, to the inside bank, an increase of the short term profit from deviating)

When the inside bank deviates from the customer relationship using concrete methods, raising the applied interest rate or quitting the loan to the firm is possible. In the next section, because we will consider what methods the inside bank chooses in deviating, for preparation we supplement a bit as follows.

In the simplified model mentioned above, we did not concretely define the length of one period, and assumed that when the firm first started a transaction with the outside bank, the inside information was accumulated in the bank for one period and the bank became the new inside bank from the next period. However, actually, if the firm, after disrupting the relationship with the inside bank, forms a new relationship with the outside bank, because it must take a long time, the information which the inside bank has does not lose the value quickly, as long as the quality of the firm does not change during the time. Therefore, if the inside bank once deviates from the relationship, and afterward can restart the

relationship while observing subsequent circumstances (δ_B et al.), the former inside bank will try to avoid leaking the information it has.

At the point of losing the customer, it is seemingly the same for the inside bank to raise the interest rate or quit the loan. However, in the case of raising the interest rate, the information produced by the inside bank may be leaked to the outside bank at no cost, through the bargaining process between the inside bank and the firm. This is important in considering the actual method of deviation for the inside bank.

4. Whether to ration credit or raise the interest rate? — From the viewpoint of the auction game.

When the inside bank deviates from the long-run customer relationship, the bank confronts the alternative of rationing credit or raising the interest rate[15]. In this section, we will consider which method the inside bank should choose.

Same as the preceding sections, we assume as follows: Although the firm which can form the customer relationship is "good", also the "bad" firm which does not form a relationship can borrow while paying the deserved interest rate. There are the inside bank and the outside bank as lenders, and asymmetric information about the quality of the customer does not exist between the inside bank and the customer (i.e. the firm or the borrower). The inside bank can propose an interest rate, which is lower than the rate the outside bank proposes, to the firm, which the inside bank recognizes as "good".

In addition, we add new assumptions as follows: If the inside bank does not disrupt the relationship, the bank lends the firm the full money that the firm wants, and then the firm does not negotiate with the outside bank. On the other hand, if the inside bank intends to disrupt the relationship, the bank chooses either raising the interest rate up to the rate the outside bank proposes or quitting the loan, and then the firm negotiates with the outside bank.

Moreover, we again emphasize the following two points described already in section 2. First, the outside bank cannot observe the rate which the inside bank actually imposes on the firm, and also the inside bank is not willing to inform the outside bank of that rate. Second, the outside bank cannot discriminate "good" firms from "bad" firms as long as the outside bank does not know the rate applied by the inside bank, because the "bad" also borrows from the inside bank[16].

In this regard, we assume each bank can know of the rate the other bank offers, if the firm starts negotiation with the outside bank[17]. In the case that the outside bank cannot observe whether or not the rate imposed by the inside bank is lower than the rate proposed by itself, this is the equipollence of the outside bank being unable to exactly evaluate and price the firm's borrowing offer. Moreover, knowing that the outside bank cannot exactly price an offer, the inside bank, confronting the alternative of rationing the credit or raising the loan rate, may choose the method preserving the value of the inside information it has.

Deviating from the customer relationship is just ending the repeated game as we saw in section 3. If there is no likelihood of restarting the game (i.e. the customer relationship), there is no merit for the inside bank to end the game while preserving the value of the inside information. As to the value of the inside information or the rent, the larger uncertainty about the information the outside bank has as to the quality of the firm, the bigger the rent stemming from the inside information the inside bank has. If, however, such an uncertainty about the information is small, the advantage the inside bank has becomes small, and then, the smaller the merit of ending the game while preserving the information value, the higher the likelihood of ending the game by not rationing credit but raising the loan rate. This is because, in the case that the value of the inside information is small, the profits the inside bank loses is small, even if the firm starts negotiation with the outside bank due to raising the loan rate.

On the other hand, there are cases in which the value of the inside information is large. Concretely speaking, the likelihood of restarting the relationship is high even if it is once disrupted, or it can take a long time to lose the inside bank's advantage stemming from the information owing to large information difference between the inside bank and the outside bank, and so on. In these cases, the likelihood of ending the game by rationing credit rather than raising the loan rate is large, because the inside bank tries to prevent the leak of the inside information and preserve its value.

Incidentally, we supplement the decision process of the loan rate. The firm starts negotiation with the outside bank as well, and searches for a lender while negotiating with both banks when the inside bank rejects the loan offer of the firm at first. In this process, each bank just shows whether or not it accepts the loan terms offered by the firm, and do not make a binding agreement beforehand by consulting the other bank mutually. Therefore, we can look upon such a decision process of the loan rate as the auction game, in which two players (i.e. the inside bank and the outside bank) take part[18].

In addition, this auction resembles an English auction, in which the asking price starts up from a low price and is made a successful bid at the highest price. In this regard, we need to reinterpret the framework of this section in that the asking price starts at a high rate and ends up at the lowest rate, because the loan rate is comparable to the price, in this section[19]. As another similar auction, there is the Dutch auction, in which the price asking starts down from a high price and is made a successful bid at the lowest price, although the Dutch auction differs from the framework of this section. That is, the asking price of the auction in this must start from a price which is not inconvenient (the Dutch auction) but convenient (the English auction) for the inside bank, because the inside bank intends to deviate from the relationship by proposing a higher loan rate than the rate based on the implicit contract.

In the English auction, the bid price continues going up [the loan rate continues going down, in this] by a certain range, and the auction continues until all players except one quit [until the other quits, because the number of the players in this is two]. This is looked

upon as reiterations of a simultaneous game. And according to the game theory as to the English auction, the bidder continues accepting the bid price until the price goes up to his appraisal price [the rate goes down to the bank's appraisal value, in this], and it is the optimal strategy to quit the game at the moment when the bid price exceeds the appraisal price. Then, in this section also, by reinterpreting the decision of the loan rate as the English auction, we will succinctly confirm the optimal strategy to the bank as follows:

We assume that the bank's valuation toward the loan terms which the firm offers is r^i in the inside bank, and r^o in the outside bank. Although the inside bank has exact information that the firm is a "good" borrower, the outside bank does not have that information , and then we assume $r^i < r^o$. In this auction, we regard the loan rate the firm offers as the bid price R_t(t=1,2,...,∞). In addition, because the loan rate in this auction starts from high rate and continues going down until either the inside bank or the outside bank quits the game, the order of the offer is $R_1 > R_2 > R_3 > \cdots > R_\infty$. The loan rate is not decided when both of the banks accept the offer, and a lower rate than last time is offered in the next time or later, and the rate is decided when either of them quits the game. At that time, the remaining bank becomes the successful bidder, and lends to the firm at the loan rate the bank actually accepts in this auction. In this auction process, if the outside bank quits with the inside bank continuing, the profit of the inside bank is $R_t - r^i > 0$, and, on the other hand, the profit of the outside bank is $R_1 - r^o > 0$. Of course, when the rate goes down under the bank's estimation (i.e. break-even) rate, because the profit becomes negative, the bank quits the game. Therefore, the optimal strategy for the banks is to continue the game as long as the profit does not become negative and to quit the game at the moment when the profit becomes so. Namely, it is to make at least the break-even rate for the bank, in all honesty.

Moreover, irrespective of whether or not both of the banks know $r^i < r^o$, the inside bank, to win the game, has only to continue the game, just because of $r^i < r^o$ as long as the firm is a "good" borrower. And when the inside bank wins, the profit of the inside bank is always $R_t - r^i = r^o - r^i > 0$.

For the inside bank that gets the rent stemming from inside information about the "good" borrower, the inside bank wins the game, because it can accept a lower rate than the outside bank, due to knowing the true value of the firm. However, it means informing the outside bank of the inside information. Therefore, to the inside bank which intends to reform the customer relationship in the future, even if deviating from the relationship is an immediate purpose, letting the outside bank know inside information is unadvisable[20]. Besides, to win the game itself is not the aim of the inside bank. That is, to the inside bank, to deviate from the relationship while preserving the value of the information within the inside bank is better. For that, not taking part in this auction initiated by the firm, namely trying not to negotiate with the firm about the loan rate, is important. In other words, to quit the loan without negotiating with the firm may be better than raising the loan rate[21].

Based on our considerations above, seen from the standpoint of the firm, this behavior of the inside bank, that is to say the firm's offer being rejected by the bank even if the firm

offers higher loan rate, is equivalent to the so-called "banks' reluctance to lend". This is the new suggestion presented in this paper, and differs from the credit rationing based on the adverse selection presented by Stiglitz-Weiss (1981). The reason that the adverse selection by the firm, which has a customer relationship with the bank, does not occur is because the "bad" firm is dropped from forming a customer relationship in the first place.

5. Immediate conclusion and remaining problems

The theoretical reinterpretation attempted in this paper, about banks' reluctance to lend under the low interest rate prevailing, is that the incentive to deviate from the long-run customer relationship as the implicit contract occurs if the discount factor for the bank's future profits falls for some reason, and the relationship is disrupted not by raising the loan rate but by quitting the loan if the value of the inside information is sufficiently large.

However, some problems still remain. First of all, it is seemingly inexplicable to try to preserve the value of the information about the customer, although the bank intends to disrupt the relationship. As to that point, in this paper, it is proposed that if the bank considers reforming the relationship, disrupted for a time, in the future, the inside bank lets the outside bank to take over the loan for as long as the value of the information remains. However, it may be more consistent if the probability of disrupting and reforming of the relationship is built into the model beforehand. For this, although it is likely that to revamp the model from a simultaneously and infinitely repeated game to a three stage sequentially repeated game is effective, this remains as a future challenge . Besides, as to the decision process of the loan rate, although the notion of the English auction is applied in this paper, checking the adequacy of this approach from the point of practical business is also needed.

Moreover, in the interpretation proposed in this paper, although it is showed that the falling of the discount factor for the bank's future profit causes the banks' reluctance to lend, to support this interpretation, empirical analysis is needed also to show what causes the falling of the discount factor.

Endnotes

1 As the first study about the implicit contract and credit rationing under the assumption of the long-run customer relationship between the lender and the borrower, there is Freid-Howitt (1980). In this regard, that study was criticized for the reason that the credit rationing was not involuntary to the borrower. However, the consciousness of that problem of that is still important when trying to ascertain the occurrence of credit rationing while thinking of the long-run relationship and the implicit contract.

2 See: Ikeo (1985); Kon (1987) as the survey about this point until the first-half of the 1980s, and Boot (2000) as the survey about the relationship with the bank until now.

3 In what follows in this paper, we regard the inside bank or the outside bank as one bank, respectively. In fact, it is usual that even a small firm borrows from plural banks, and, for example, Carletti (2004) focuses on borrowing from plural banks and analyzes the significance and the effect.

4 Although we describe the merit of the firm as the risk-averter here, if the implicit interest rate applied by the inside bank is lower than the rate applied by the outside bank, we can describe the merit of the firm under the long-run customer relationship, irrespective of whether or not the firm is the risk-averter. For example, Sharpe (1990) explained the merit of the firm under the relationship, based on the assumption of being risk-neutral. Also in the framework in the next section, we can affirm the merit of the firm, even if risk-neutral, by distributing the parts of the rent accrued by the inside bank to the customer firm.

5 See Ikeo (1985), pp.36-39. When regarding the information as the goods, the market failure occurs owing to the nature of the public goods, and then it is likely that dealing of this kind of information is impossible, between banks, or by the intervention of a special information producer.

6 To acquire more profitable terms in borrowing, the firm can do unreal reports, and, on the other hand, the outside bank cannot affirm whether or not the reports are true. Besides, even when the bank realizes the reports are unreal after the fact, the degree of the penalties, which the bank can impose on the firm that is not the customer, is limited. Therefore, even if the firm reports the truth, the outside bank cannot estimate whether or not the reports are true.

7 This explanation is more simplified than what Sharpe (1990) proposed. As to that case the information about the firm (the conditional probability of the project), observed by the outside bank, includes the noise signal in the two period model. See the original, Sharpe (1990).

8 Although the following consideration is based on Baglioni (1992), the formulation and the conclusions differ a bit.

9 See, e.g. Okada (1996), p.219, as to the strict definition of the subgame perfect equilibrium in the repeated game.

10 We will consider the case when the firm deviates from the customer relationship with the present inside bank and starts a transaction with the outside bank in this period, and continues the transaction with the same outside bank from the next period. In this case, the outside bank becomes the new inside bank through accumulation of inside information from the next period. As is given that the present inside bank does not intend to deviate from the relationship, if the firm changes its bank, although the firm cannot get part of the rent, instead, it can get profit as a part of the rent the new inside bank gets by continuing the relationship through the infinitely repeated game, from the next period. If the sum of the discounted present value of the profit is smaller than the sum of the discounted present value of the profit in continuing the relationship with the present inside bank, the firm does not have an incentive to deviate from the present relationship.

In this period, if the firm changes its bank to the outside bank, this bank becomes the inside bank from the next period. We denote the rate the new inside bank proposes as $\bar{r}'$. The firm gets the profit $r^o-\bar{r}'>0$ (as the distribution of the rent) each period from the next period. On the other hand, when continuing the relationship with the present inside bank, the firm gets the profit $r^o-\bar{r}>0$ (as the distribution of the rent) each period from this period. We denote the discount factor of future profits to the firm as δ_F ($=1\div(1+$discount rate)), and then,

$$\frac{\delta_F}{1-\delta_F}(r^o-\bar{r}')\leq\frac{1}{1-\delta_F}(r^o-\bar{r}).$$

When this equation holds, the firm does not deviate from the relationship with the inside bank. Transforming this equation, $\bar{r}\leq r^o+(\bar{r}'-r^o)\,\delta_F$. From $(\bar{r}'-r^o)<0$, the smaller δ_F or the larger $\bar{r}$, the larger the likelihood which the inequality sign holds, and, in that case, the firm does not deviate from the present relationship. On the other hand, the larger δ_F or the smaller $\bar{r}'$, the larger the likelihood which the firm deviates from the present relationship. However, if it is not assured in this period that the rate $\bar{r}'$ imposed by the outside bank is so sufficiently low that the condition of inequality sign of the equation is violated, the firm continues the present relationship with the inside bank. In this regard, as we saw in section 2, because the inside bank does not have the incentive to inform the outside bank of the level of $\bar{r}$, the outside bank cannot assure the firm of the rate

r^{*} which is so low that the condition of inequality sign is violated, because it does not know the level of $\bar{r}$ in this period.

Or, it can also occur that when the firm does not continue the transaction with the outside bank after deviating from the relationship with the present inside bank, it is because the firm cannot get part of the rent of the bank, so the firm does not have the incentive to deviate from the relationship with the present inside bank.

11 As considered above, it is given that the behavior strategy for other player is the cooperative strategy. If either of them takes the non-cooperative strategy (i.e. deviating from the relationship), the game ends at that time, and neither of the players can get a portion of the rent. Aside from that, even if one other player takes the non-cooperative strategy, the other takes the cooperative strategy. As long as the game ends at that time, it does not happen that the profit of the cooperative party becomes smaller than when taking the non-cooperative strategy. Therefore, irrespective of whether the other player's strategy is cooperative or non-cooperative, taking the cooperative strategy is rational. As a result, when the inequality, which is considered in this section, holds, taking the cooperative strategy as the pure strategy, to both of them, constitutes the subgame perfect equilibrium.

12 Although we do not assume that r^{i} rises because of the assumption that the quality of the firm does not change in this, if it rises, that also causes the disruption of the relationship. However, as long as that is due to the disruption of the relationship based on the firm's risk rising, that differs from "banks' reluctance to lend", the subject of this paper.

13 As the reason why the Japanese banks have come to prefer near future profits than further future, we may point out that the Japanese government had changed the definition of the bad asset of the banks several times during the second -half of the 1990s, the pressure to accelerate charge-off had been increasing, the uncertainty of the authorities' posture on banking supervision had risen, the rating of Japanese banks in the international financial markets had deteriorated, and so on. In this regard, to clarify the reasons, empirical studies are needed, and they remain as the future challenge of this study.

14 When the probabilities of bankruptcy to all firms rise, through the deterioration of the macro economy, that affects both r^{o} and δ_{B}.

15 We treat the technical term, "credit rationing" more widely than the usual usage, and use the term in the meaning that banks do not loan under any loan rate.

16 In this, the description is simplified in that the outside bank can also know the quality of the firm while only knowing the rate applied by the inside bank. However, because, in fact, the corporation's performance is a probability valuable, and the information only about the level of the loan rate at a special time just shows the special break-even rate realized under the conditional probability, only knowing the rate is insufficient to evaluate the exact quality of the firm. More accurately speaking, to know the quality, it is necessary to know what levels of rate the inside bank had imposed upon the firm in various phases.

17 The level of interest rate and the amount of loans of individual loan projects are not open information. However, when we think that the firm negotiates with the bank while showing the rate proposed by other banks, we can interpret that each bank indirectly knows the rate through the firm.

18 In analyzing an auction as a game, the seller is usually not included in the analysis, and the process in which plural buyers compete to make a successful bid is analyzed. In the framework of this section, although the firm also takes part in the game, because the firm is comparable to the seller in the auction game, the firm is not included in the players.

19 As to the auctions, there are the English auction, the Dutch auction, the sealed-bid first-price auction, and the sealed-bid second-price auction (See e.g. Krishna (2002), pp.2-3; Dutta (1999), pp.367-377).

20 When the borrower is "good", the outside bank may attempt to rob the inside bank of the borrower by proposing a daringly low rate at the risk of a temporary loss, if can know the true quality of the borrower.

21 When the borrower, the customer of the inside bank, cannot borrow from the inside bank, the borrower may inform the outside bank of that and intend to borrow from the bank. However, as mentioned in section 2, because the outside bank cannot exactly know the quality of the borrower, to the new borrowers, it cannot help proposing the high rate applied to "bad" borrower.

22 In the framework of this study, when the inside bank quits the loan, the firm cannot discriminate whether the bank's action is only a temporary break or permanent quitting. For example, even if the inside bank just quits the loan while intending to restart the relationship in the future, the firm may deem the relationship to be disrupted and change its bank. Therefore, to avoid this, the inside bank must predict the firm's action when deciding whether or not it should lend. And, because the firm's action depends on the estimation of the bank's intentions, the bank must also consider how its own actions affect the firm's estimation.

To build the probability of disrupting and reforming of the relationship into a model while considering this problem mentioned above, it seems that to consider this game as a three-stage model is needed, as follows: In the first stage, the bank's discount factor is decided as stochastic event and the bank decides whether or not it should lend. In the second stage, when the bank quits the loan, the firm decides whether or not it should borrow from the outside bank based on its own prediction about the bank's action in the next stage. In the third stage, the bank's discount factor is again decided and the bank decides whether or not it should lend. As to the third stage, we assume infinite periods from the time, and, in that stage, the discount factor is constant.

Besides, other considerations are also needed. First, the result of the analysis will differ depending on whether or not the information gaps between the inside bank and the outside bank about the quality of the firm are constant. Second, the result will also differ depending on whether or not both or either the bank and the firm know the discount factor of the bank. As to latter point, when the information is asymmetric between the bank and the firm, it may need to be considered as the sequentially repeated game, and to describe the model as a stochastic phenomenon. These points and problems remain as a future challenge.

REFERENCES

Baglioni, A. (1992), "Bank-Firm Customer Relationships as Dynamic Game Equilibria", Rivista Internazionale di Scienze Economiche e Commerciali, Vol.39, iss.10-11, pp. 943-958.

Berger, A.N. and Udell,G.F. (1994), "Did Risk-Based Capital Allocate Bank Credit and Cause a "Credit Crunch" in the United States ? " Journal of Money, Credit and Banking, Vol.26, No.3, pp.585-628.

Bernankle, B.S. and Lown, C.S. (1991), "The Credit Crunch", Brookings Papers on Economic Activity, 1991, iss.2, pp.205-247.

Boot, A.W. (2000), "Relationship Banking: What Do We Know?", Journal of Financial Intermediation, Vol.9, iss. 1, pp.7-25.

Carletti, E. (2004), "The Structure of Bank Relationships, Endogenous Monitoring, and Loan Rates", Journal of Financial Intermediation, Vol.13, iss. 1, pp.58-86.

Dutta, P.K. (1999), Strategies and Games, the MIT press.

Fama, E.F. (1985), "What's Different About Banks?", Journal of Monetary Economics, Vol.15 iss.1, pp.29-39.

Freid, J. and Howitt, P. (1980), "Credit Rationing and Implicit Contract Theory", Journal of Money, Credit and Banling, Vol.12, No.13, pp.471-487.

Fueda, I. (1999), Ginko Kashidashi no Nobinayami nitsuite -Kashishiburi nikansuru Kousatsu, NIHON KEIZAI KENKYU CENTER KAIHOU, No. 825, Japan Center for Economic Researh, Aug., 1999. (in Japanese)

Ikeo, K. (1985), Nihon no Kinyu Shijo to Soshiki, Toyo Keizai. (in Japanese)

Ito, T. and Sasaki, Y. (1998), "Impact of the Basle Capital Standard on Japanese Banks' Behabior", NBER Working Paper Series, No. 6730.

Kon, Y. (1987), Ginko Koudou no Keizai Bunseki, Toyo Keizai. (in Japanese)

Krishna, V. (2002), Auction Theory, Academic Press.

Maeda, T. (1996), "Wagakuuni Ginkogyo niokeru Kashidasi Nobinayami nitsuite-"Kashi Shiburi" ron nikansuru Kousatsu to Jisshobunseki", FINANCIAL REVIEW, Vol.39, pp.131-151., Ministry of Finance, Policy Research Institute. (in Japanese)

Okada, A. (1996), Game Riron, Yuhikaku. (in Japanese)

Sasaki, Y. (2000), Minkan Kinyu Kikan no Prudential policy, Tokyo Yuseikyoku Chokinbu Itaku Kenkyu Houkokusho. (in Japanese)

Stiglitz, J.E. and Weiss, A. (1981), "Credit Rationing in Markets with Imperfect Information", American Economic Review, Vol.71, iss.3, pp.393-410.

Sharpe, S.A. (1990), "Asymmetric Information, Bank Lending, and Implicit Contracts: A Stylized Model of Customer Relationships.", Journal of Finance, Vol.45 iss.4, pp.1069-1087.

Yoshikawa, H., Etou, M., and Ike, T. (1994), "Chusho Kigyou nitaisuru Ginkou niyoru 'Kashi Shiburi' nitsuite", KEIZAI BUNSEKI Seisaku Kenkyu no Shiten Series 1, Economic and Social Research Institute, May., 1994. (in Japanese)

[Abstract]

Japanese Banks' Behavior Under Long-run Customer Relationships in the Second-half of the 1990s

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This article, informed by a version of game theory, purports to reinterpret the 'credit crunch' that hit Japanese banks in the second half of the 1990s in spite of the prevailing low interest rates.　This study first indicates that a bank may disrupt its continual customer relationships based on an implicit agreement, if and when the discount factor for the bank's future profits falls.　It is further suggested that the disruption may take the form of credit rationing, rather than the operation of interest rates, when the bank desires that its information regarding customers' credit positions（accumulated through past dealings）, not be known to its rivals.

Key words: Long-run Customer Relationship, Credit Rationing, Credit Crunch